Chapter – 6

Reliability, Validity & Norms

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Chapter – 6

Reliability, Validity & Norms

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Chapter -6

Reliability, Validity & Norms

6.1.0 Introduction :

In the previous chapter, we discussed and elaborated on the process of tool construction.

The main purpose of any tool is to obtain data which is reliable and valid so the researcher can read the prevalent situation accurately and arrive at some conclusions to offer some suggestions. However, no tool is perfectly reliable or valid. So, it should be accompanied by a statement of its reliability and validity. Here, in this chapter, the estimation of reliability and validity of the inventory constructed are discussed along with its norms in detail.

6.2.0 Reliability :

Reliability of a test pertains to reliable measurement which means that the measurement is accurate and free from any sort of error. Reliability is one of the most essential characteristic of a test. If a test gives same result on different occasions, it is said to be reliable. So Reliability means consistency of the test result, internal consistency and consistency of results over a period of time.

According to Anastasi and Ubrina (1982)[1]

> *"Reliability referes to the consistency of scores obtained by the same persons when they are re-examined with the same test on different occasions, or with different sets of equivalent items, or under other variable examining conditions."*

Reliability is defined mathematically as the ratio of the variation of the true score and the variation of the observed score. Or, equivalently, one minus the ratio of the variation of the error score and the variation of the observed score.

$r_{x.x}$ is the symbol for the reliability of the observed score x, and x^2, T^2 and E^2 are the variances of the measured, true and error scores respectively. However, there is no direct way to observe or calculate the true score, so a variety of methods are used to estimate the reliability of a test.

6.2.1 Types of Reliability :

There are four general types of reliability.

- **Inter-rater or Inter-observer Reliability :** Measures the degree to which different observers give consistent estimates of the same persons.
- **Test - Re-test Reliability :** Measures the consistency of measurement on two separate occasions.
- **Parallel-Forms Reliability :** Measures the consistency of results of two parallel forms of same test constructed in the same way.
- **Internal consistency Reliability :** Measures the consistency of results across items within a test.

A. **Split - Half Reliability**

- Spearman and Brown formula
- Rulon - Guttman's formulas
- Flanagan Formula

B. **Cronbach's Alpha**

- Methods of Rational Equivalence
- Kuder Richardson - KR_{20}
- Kuder Richardson - KR_{21}

6.2.2 Reliability of the Present Inventory:

In the present study, the reliability of the SRL Inventory was estimated by

- Test-Re-test method
- Split-Half method
- Cronbach's Alpha (α) (Internal Consistency)

(A) Test-Retest method

This type of Reliability is estimated by the Pearson product - moment coefficient of correlations between two administrations of the same inventory. Estimation is based on the correlation between scores of two or more administrations of the same inventory.

For the present study, a sample of 207 students representing all the four variables of area (Urban-rural), stream (Science-General), standard (XI-XII) and gender (Boys-Girls) were selected from the sample for the final test run. They

were administered the same inventory after one month of the final run. The Pearson product-moment correlation was calculated for the two sets of scores as follows.

Formula for Pearson Product-Moment Correlation[2]

$$r = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{N\sigma_x.\sigma_y}$$ Where

r = Correlation between x & y

x_i = ith value of x variable.

$\bar{x}$ = mean of x

y_i = ith value of y variable.

$\bar{y}$ = mean of y

N = Number of pairs of observations of x & y

σ_x = Standard deviation of x (test)

σ_y = Standard deviation of y (retest)

The scores for test and retest of the selected 207 students were entered into an excel spread sheet. The coefficient of correlation r and SE_r were computed by using NRTVB-99 software. the value derived were r = 0.9823 ≈ 0.98

(B) Split - Half method:

In this method, the inventory was divided into two equal halves and correlation between scores of these halves was worked out. The measuring instrument can be divided in various ways but the best way to divide the measuring instrument into two halves is odd numbered and even numbered items. This coefficient of the correlation denotes the reliability of the half test. Entire information regarding items in each half, item wise scores, difference 'd', SD for both the halves i.e. SD of first half σ_1, SD for second half σ_2 and SD for entire σ_t, Variance for odd items σ_1^2 was 455.46, variance for even items σ_2^2 was 359.17 and total variance σ_t^2 was 1115.18.

In the present study, the coefficient of correlation was calculated by using following formula

- Spearman and Brown formula
- Rulon formula.
- Flanagan Formula

- **Spearman and Brown Formula :-** The spearman and Brown formula estimates the reliability of a test **n** times. From the reliability of the half test, the self-correlations coefficient of the whole test is estimated by the following formula[3].

Spearman Brown Formula: $r_{tt} = \frac{2r_{hh}}{1+ r_{hh}}$

Where

r_{tt} = Reliability coefficient of the whole test

r_{hh} = Reliability coefficient of the half test

$$r = \frac{2r_{\frac{1}{2}.\frac{I}{II}}}{1+ r_{\frac{1}{2}.\frac{I}{II}}}$$

$$r = \frac{2 \times 0.88}{1+ 0.88}$$

$$r = 0.93$$

As the value indicates very high correlation, it can be said that SRL inventory is reliable.

- **Rulon Formula :-** In this method, the variance of the differences between each person's scores on the two half-tests and the variance of total scores are considered.

The Rulon formula is as under[4]

$$r_{tt} = 1 - \frac{SD_d^2}{SD_x^2}$$

Where

r_{tt} = Reliability of the test

SD_d^2 = Variance of the differences between each person's scores on the two half test

SD_x^2 = Variance of total score

The data of the split-half were used and σ_d and σ_t were computed. They were as under

$(\sigma_d)^2$ = 135.53

$(\sigma_t)^2$ = 2049.59

These value were inserted in the above mentioned formula and r_{tt} was computed as under.

$$r_{tt} = 1 - \frac{135.53}{2049.59}$$

$$r_{tt} = 0.93$$

The value thus found is r_{tt} = 0.93, which indicates that the SRL Inventory is reliable.

- **Flanagan Formula :** This formula is very close to Rulon's formula. In this formula the variance of two halves are added instead of difference between two halves. The formula is as under[5]

$$r_{tt} = 2\left(1 - \frac{(\sigma_1)^2 + (\sigma_2)^2}{(\sigma_t)^2}\right)$$

Where

r_{tt}	=	Reliability of the test
$(\sigma_1)^2$	=	Variance of scores of 1st half (odd numbered items)
$(\sigma_2)^2$	=	Variance of scores of 2nd half (even numbered items)
$(\sigma_t)^2$	=	Variance of total scores

The value of d, d^2, x_t and x_t^2 where derived while computing the split half reliability and σ_1^2, σ_2^2 and σ_t^2 were computed with the help of software by using excel spread sheet. The values found were $\sigma_1^2 = 23.12$, $\sigma_2^2 = 23.62$, $\sigma_t^2 = 45.27$. These values were inserted in the formula and the computation was done

$$r_{tt} = 2\left(1 - \frac{(\sigma_1)^2 + (\sigma_2)^2}{(\sigma_t)^2}\right)$$

$$r_{tt} = 2\left(1 - \frac{23.12^2 + 23.62^2}{45.27^2}\right)$$

= 2(0.47)

r_{tt} = 0.94

These three formulas gave almost same values of coefficient of correlation. It shows that the present inventory is highly reliable.

(C) Cronbach's alpha (α) :

This method is commonly used as a measure of internal consistency or reliability of a test. This was developed by Lee Cronbach in 1951. As an extension of the Kuder-Richardson formula (KR_{20}). This method uses the variance of scores of odd, even and total items to workout the reliability. The software NRTVB-99 is based on the following formula.

$$\text{Cronbach's } \alpha = 2[1-(\sigma^2\text{odd} + \sigma^2\text{even})\ \sigma^2\text{ total})$$

The scores of all 2000 students on 80 items were entered into an excel software we got the value of Cronbach's α directly as 0.89 This value also indicates very good internal consistency in the present inventory.

6.2.3 Summary of the reliability :

To get a comprehensive view of the Reliability of the inventory to identify Self Regulated Learners (SRLs), reliability coefficients computed with the help of different methods are shown in the table 6.2.3

Table 6.2.3
Summary of Reliability coeffienct

Type of Reliability		Value of r
A.	Test - Retest	0.98
B.	Internal Consistency : Split-Half Reliability	
	1. Spearman and Brown Formula	0.93
	2. Rulon Formula	0.93
	3. Flanagan Formula	0.94
C.	Cronbach's alpha (α)	0.89

The values of reliability coefficients for SRL Inventory by different methods are very high. So, it can be said that the SRL Inventory is highly reliable.

6.3.0 Validity :

Test validity referees to the degree to which the tool actually measures what it claims to measure. Validity can be defined as the accuracy with which the scale measure what it claims to measure. Validity and purpose are like two sides of a coin.

Any measuring instrument which fulfils the purpose for which it is developed can be called a valid measuring instrument. It is also the extent to which the inferences and conclusions made on the basis of scores earned on measuring are appropiate and meaningful.

According to H. E. Garrett (1965)[6]

> *"The validity of a test or any measuring instrument depends upon the fidelity with which it measures what it proposes to measure."*

According to Freeman (1960)[7]

> *"An index of validity shows the degree to which a test measures what it purpose to measure when compared with accepted criteria"*

According to Anastasi (2007)[8]

> *"The validity of a test concerns with what the test measures and how well it does so."*

The first essential quality that any valid test should possess is Reliability. Reliability of any test can be estimated by repetition of measurements but validity of a test can be estimated by comparing the performance with some standard criterion. The Validation of a test score is the most important step in the process of standarization of any tool. Therefore, every constructor has to establish the validity of the tool to ensure its acceptability.

6.3.1 Types of Validity :

All procedures for determining test validity are concerned with relationship between performance on a test and other independenly observable facts about the behaviour characterstics under consideration.

According to Anastasi (1970)[9]

> *"The APA Technical Recommendations have classified these procedures under four categories, designated as content, predictive, concurrent and construct validity. Out of these four categories of validity the two namely content and construct or concept validity are described under the heading of rational validity, by many authors. Similarly concurrent, predictive and congruent validity are described under the heading of empirical or statistical validity. In these methods the validity is estimated by means of statistical techniques."*

Procedures for determining validity are primarily concerned with the performance on test and other observable characteristics under consideration. Validity can be established by following methods.

Methods for Determining Validity :

- **Face Validity**

  This is not validity in technical sense as it is not concerned with what the test actually measures. It pertains to the fact that whether test looks valid or not. For this, the proposed instrument is to be sent to the experts in the related area and are requested to judge whether it actually measures for what it is constructed.

- **Congruent Validity**

  This type of validity is estimated by a statistical technique by correlating the scores earned on the present test with scores earned on any other valid, reliable test. But in this case no test of similar nature was available for the targeted population. So it was not possible to estimate the congruent validity for the SRL Inventory.

- **Concurrent Validity**

  Concurrent validation is relevant to tests employed for diagnosis of existing status. The criterion for it is always available at the time of testing.

- **Construct Validity**

  This type of validity is concerned with what qualities does a test measure. It is evaluated by demonstrating that certain explanatory constructs account for some degree of performance on the test.

  Construct validity can be estimated by following two methods.

  (i) Internal Consistency

  (ii) Factorial Validity

(1) Internal Consistency :-

Test falling under personality domain are validated by this method. The essential character of this method is the total score on the test itself. It verifies that a particular item or section measures the same characteristic individually that the test as a whole measures. It can be determined in two ways.

(a.) By comparing the performance of upper criterion group with that of the lower criterion group. Biserial correlation between 'Pass-Fail' on each item and total test score is computed and items yielding significant item test correlations are retained.

(b.) By correlating sub-test scores with total score. Any subtest having low correlation is estimated.

Internal consistency correlation are essential as they help to characterise the behaviour domain or trait sampled by the test.

Factor Analysis :-

Factor analysis is a refined statistical technique for analysing interrelationships of behaviour data. The factorial validity of a test is the correlation between he test and the factor common to the test. It is simply the factor loading of a particular factor in the test in question.

According to Ebel (1966)[10]

> *"Factorial validity of a test is the correlation between that test and the factor common to a group of tests or other measures of behaviours such as validity is based on factor analysis."*

Factor analysis is a systematic method for examining the meaning of the test studying its correlation with other variables. In the process of factor analysis the number of variables or categories is reduced from the number of original tests to a relatively small number of factors or common traits. Major purpose is to simplify the description of behaviour by reducing the number of categories. After identifying the factors, each test can be characterised in terms of major factors determining its scores, weight or load of each factor and the correlation of each factor with the test. So, correlation of each factor with the test is known as factorial validity of the test.

One of the objectives of factor analysis is to analyse the common variance to determine the number and types of common variances which are responsible for the correlations between variables. The values of the square roots of the common variance are known as factor loading. Each factor loading represents the amount of correlation of the sub-traits with that factor.

The procedures for extracting factors that are most commonly used are as follows :

1. The centroid method of Thurstone
2. Method of summation of Burt.
3. Method of Principal axes of Kelley.
4. Method of Principal components of Hotelling.

6.3.2 Validity of the present Inventory

Validity for SRL Inventory was established by following methods.

(A) Face Validity :

The researcher selected ten experts from the faculty of Education and Psychology and sent the proposed inventory for their opinion about it strength of measuring the trait to be measured and suggestions. The inventory contained 104 items spread over three subscales. After combining all expert opinions, 19 statements required some sort of modification. The concerned statements were modified as per suggestions made by them in consultation with the guide. The four statements rejected by the experts were removed form the inventory. Their list is appended as Appendix VI(A). The list of statements with their modified version is appended as Appendix VI(B)

As 81 statements were accepted and approved by the experts without any changes to measure the said traits and only 19 required some sort of modifications so it was concluded that the inventory possessed good amount of face validity.

(B) Construct Validity :

The construct validity for the SRL inventory was estimated by the following two methods.

(i) Internal consistency using t value of each item in different try outs.

(ii) Factorial validity.

(i) Internal Consistency :-

To estimate validity for the inventory, t values for each item determined in different try outs were used. For this, the data of Pilot run, Second try out and re-test were taken and Mean, SD, and t value were computed for each item on the basis of discriminated value. Table 6.3.2.0 showing item wise t value for each try out is presented here.

Table No. 6.3.2.0

Item wise t Value for different try outs

Item No.	Pilot Run	First Try-out	Re-Test
1	4.93	2.85	2.08
2	5.76	3.79	1.43
3	3.63	4.18	5.09
4	7.85	4.91	5.10
5	5.18	8.69	6.98
6	3.45	2.04	0.15
7	7.40	3.55	6.13
8	7.46	4.17	9.55
9	7.26	6.10	4.99
10	4.23	4.41	6.39
11	7.27	4.64	3.64
12	6.24	4.95	11.22
13	5.41	5.71	14.53
14	7.29	6.21	4.83
15	6.35	6.34	8.72
16	4.16	7.69	6.43
17	6.84	8.29	3.31
18	5.92	2.63	8.86
19	6.64	3.55	5.88
20	6.35	6.90	4.64
21	2.31	1.93	3.71
22	6.05	4.82	7.86
23	5.34	5.07	6.69
24	7.53	5.44	5.21
25	8.73	5.79	6.47
26	7.05	2.67	5.06
27	9.96	6.51	9.96
28	9.49	9.06	15.52
29	13.15	8.47	6.79
30	5.64	2.78	5.70
31	9.75	6.81	8.16
32	4.98	5.02	10.85
33	10.11	6.16	6.27
34	12.09	8.70	5.40
35	9.16	9.74	5.35
36	7.96	5.70	2.86
37	5.64	7.08	8.55
38	6.85	8.67	8.13
39	9.56	8.77	6.43
40	7.08	9.46	9.32
41	8.94	10.78	9.94
42	6.66	4.68	7.36
43	5.49	2.17	1.60
44	2.14	5.46	3.89
45	5.61	7.50	11.01
46	11.91	8.12	11.05
47	11.47	9.25	15.30
48	4.46	10.10	6.90
49	9.11	12.14	11.03
50	11.29	13.70	12.34
51	6.85	6.03	1.99
52	13.11	7.82	15.48
53	7.07	4.68	2.28
54	11.85	5.96	15.99
55	11.04	6.79	4.97
56	8.66	6.85	3.51
57	11.87	7.15	11.48
58	6.66	7.15	7.50
59	8.66	7.78	5.27
60	9.37	8.19	7.39
61	8.08	8.42	10.97
62	9.28	10.05	8.81
63	14.56	10.10	25.24
64	12.70	10.61	15.60
65	6.76	11.36	7.50
66	10.22	11.64	8.92
67	3.06	2.89	5.40
68	7.56	5.27	6.82
69	8.33	8.46	4.24
70	7.11	4.72	4.24
71	9.88	6.86	4.95
72	6.91	8.28	1.87
73	7.03	4.31	5.83
74	13.23	4.48	4.11
75	9.77	5.44	5.70
76	9.72	5.95	12.01
77	6.06	8.39	2.01
78	11.40	8.52	17.31
79	8.01	3.53	6.81
80	7.50	7.82	5.71

N	80	80	80
Mean	7.79	7.50	7.73
SD	2.62	2.42	2.47

Three pair were formed by combining Pilot run with First tryout, Pilot run with Re-test, First tryout with Re-test. The 't' values for each pair was computed and are presented in the Table No. 6.3.2.1

Table :6.3.2.1
Pair wise N, Mean of t value and its SD along with t-value

Pair No.	Try Out	N	Mean	SD	SE_M	SE_D	D	t
1	Pilot	80	7.79	2.62	0.29	0.28	0.29	1.04
	First	80	7.50	2.42	0.27			
2	Pilot	80	7.79	2.62	0.29	0.28	0.06	0.23
	Re-test	80	7.73	2.47	0.28			
3	First	80	7.50	2.42	0.27	0.27	0.22	0.83
	Re-test	80	7.73	2.47	0.28			

It is observed from the table No. 6.3.2.1 that t value for each pair is not significant at any level of significance so the tool can be said to be highly consistent and valid.

(ii) Factorial Validity :-

As Thurstone's centroid method is very popular and widely used by veteran phycologists, it was used in the present study also.

To estimate factorial validity of the SRL Inventory, total scores of each sub scale (Metacognition, Motivation and Behariour) were taken and entered into excel sheet by using Ms-Office programme, correlation between two subtests were computed and are presented as correlation matrix in table 6.3.2.2

Table : 6.3.2.2
Correlation Matrix

	Sub test-I	Sub test-II	Sub test-III
Sub test-I	-	-	-
Sub test-II	0.6682	-	-
Sub test-III	0.7870	0.8180	-
Total	0.8851	0.9092	0.9521

With the help of correlation matrix, factor loading was computed with the help of centroid method. Eigen values for each subtest (factor) were also worked out and are presented in table 6.3.2.3

Table : 6.3.2.3
Variance explained by different factors

Factor	Eigen Value	Percentage of Variance	Cumulative Percentage
1	6.552	39.7621	39.7621
2	5.183	31.4540	71.2161
3	4.743	28.7838	100

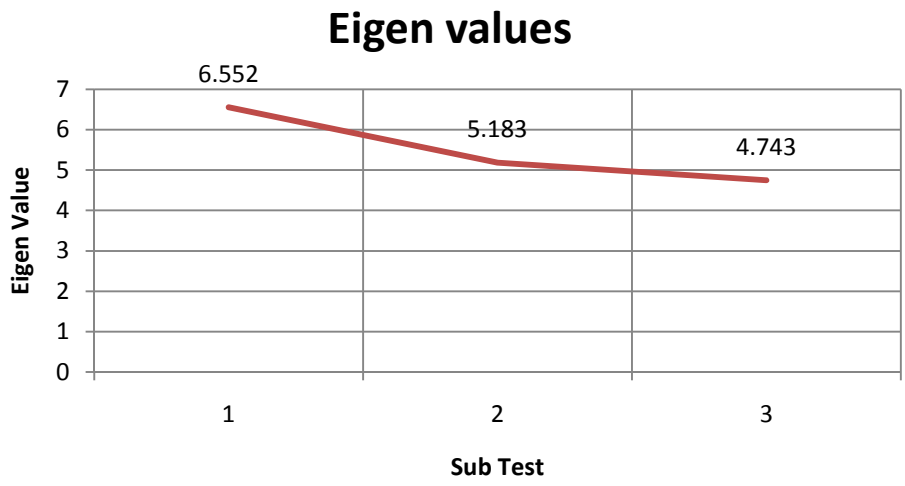
The factor loading for each sub test in form of Eigen values was traced out and it is presented in table 6.3.2.4

Table : 6.3.2.4
Factor Loading

Sub test	Facotr - 1
1	0.752
2	0.698
3	0.642

Eigen values for each subtest were plotted and a line graph was prepared. It is presented as graph no. 6.3.2.4

Graph : 6.3.2.4



It is observed from Eigen values, its graph and factor loading for each sub test that this inventory has the ability to measure general factor (Self-regulated learners) and specific factors (Matecognition, Motivation, and Behaviour). So that the SRL inventory possess high factorial validity.

6.3.3 Summary of The Validity

The process of estimating validity, the types and methods has been discussed in 6.3.1. the validity estimates for the SRL Inventory were worked out in 6.3.2 and the results are summarised presented here in table 6.3.3

Table :6.3.3
Validity for SRL Inventory

Sr No..	Type of Validity	Remark
1	Face Validity	Good face Valdity
2	Construct Validity	Good
	(iii) Internal Consistency	Consistency in t-value for Each item.
	(iv) Factorial Validity	High Factor Value (0.86)

It is observed from the table 6.3.3 that the preset SRL inventory is valid and possess high potential to identify self-regulated learners from the higher secondary school students.

6.4.0 Norms :

A norm represents a typical level of performance for a particular group. A raw score on any Psychological test alone is meaningless unless we have additional interpretive data. So the score on psychological test are most commonly interpreted by reference to norms that represent the test performance of the standardised sample. Norms are empirically established by determining what parsons in a representative group actually do on a test. In order to ascertain more precisely the individual's exact position with reference to the standardised sample, the raw score is converted into some relative measure. These derived scores serve two purposes.

1. They indicate the individual's relative standing in the normative sample and facilitate evaluation of performance.
2. They provide comparable measures that permit a direct comparison of the individuals performance on different tests.

6.4.1 Types of Norms :

Fundamentally, derived scores are expressed in one of two major ways (1) Development Norms and (2) Within group Norms.

(1) Developmental Norms :-

These type of norms generally indicate the normal developmental path the individual has progressed. They are very helpful for descriptive purpose but they are not compatible to precise statistical treatment. The types of development norms are (a) Mental Age Norms, (b) Grade Equivalent Norms and (c) Ordinal Scale Norms.

(2) Within Group Norms :-

Such type of norms help in comparing the individual's performance with the most nearly comparable standardised group's performance. Within group norms have a uniform and clearly defined quantitative meaning and can be appropriately employed in most types of statistical analyses.

a. **Percentiles ($P_{(n)}$ and PR):-** Percentile scores represent the percentage of persons in the standardised sample who fall below a given raw score. They indicate an individual's relative position in the standardized sample. In case of percentiles, the counting begins from the bottom so lower the percentile, poorer the standing / rank.

b. **Standard Score :-** Standard score express the individual's distance from the Mean in terms of the standard deviation of the distribution. They are obtained by linear or nonlinear transformation of the original raw scores. T Scores and Z scores are known as standard scores.

c. **Age Norms :-** To establish age norms, the Mean of raw scores obtained by all in the same age group within a standardized sample is taken. So Mean raw score of 12 year old students would represent the 12 years norm.

d. **Grade Norms :-** Grade norms are found by computing the Mean row score obtained by students in particular grade.

6.4.2 Norms for the present SRL Inventory :-

It is required to establish norms for all those variables which had significant effect on the outcome of the test raw score. The data of all 2000 students were entered into excel sheet of Ms Office programme and naturally divisible variable wise and its strata wise Mean and SD were computed and t-value for each variable were also computed. These data are presented in table 6.4.2(A)

Table :6.4.2. (A)
Pair wise N, Mean, SD along with t-value

Variable	Type	N	Mean	SD	M.diff	SE_D	t	Remark
Area	Urban	1000	300.767	44.77	1.380	2.024	0.68	N.S.
	Rural	1000	299.387	45.78				
Gender	Boys	1000	297.240	45.19	5.674	2.021	2.80	**
	Girls	1000	302.914	45.20				
Stream	Science	800	301.548	46.41	2.450	2.083	1.17	N.S.
	General	1200	299.097	44.49				
Standard	11	1000	296.700	45.51	6.754	2.01	3.34	**
	12	1000	303.454	44.81				

It is observed from the table that Area and Stream has no significant effect on SRL score while Gender and Standard has significant effect on SRL score. As per theoretical guideline, if the variable has significant effect, norms are to be established for them. So that in the present study, Gender and Standard wise norms were worked out. After analysing total score of 2000 students earned on SRL inventory, It was found that maximum score and minimum score were 382 and 217 respectively. So that PR and T scores were computed for the range of 217 to 382. The norms are presented in table 6.4.2(B)

Table No. 6.4.2(B)
Norm Table

Score	XI				XII			
	Male		Female		Male		Female	
	PR	T Score	PR	T Score	PR	T Score	PR	T Score
382	99.90	68.79	99.70	67.75	99.40	67.09	99.90	66.76
381	99.80	68.58	99.40	67.54	98.80	66.88	99.80	66.56
380	99.70	68.37	99.40	67.33	98.30	66.67	99.40	66.35
379	99.60	68.15	99.40	67.12	97.80	66.46	99.00	66.14
378	99.60	67.94	99.40	66.90	97.80	66.25	99.00	65.93
377	99.60	67.73	99.40	66.69	97.80	66.03	99.00	65.73
376	99.60	67.52	99.40	66.48	97.80	65.82	99.00	65.52
375	99.60	67.30	99.40	66.26	97.80	65.61	99.00	65.31
374	99.60	67.09	99.40	66.05	97.80	65.40	99.00	65.11
373	99.50	66.88	99.10	65.84	97.50	65.18	98.20	64.90
372	99.40	66.67	98.80	65.63	97.20	64.97	97.40	64.69
371	99.40	66.45	98.80	65.41	97.20	64.76	97.40	64.48
370	99.40	66.24	98.80	65.20	97.20	64.55	97.40	64.28
369	99.10	66.03	98.00	64.99	96.90	64.34	96.80	64.07
368	98.80	65.82	97.20	64.78	96.60	64.12	96.20	63.86
367	98.80	65.60	97.20	64.56	96.60	63.91	96.20	63.66
366	95.80	65.39	93.40	64.35	94.60	63.70	93.80	63.45
365	92.80	65.18	89.60	64.14	92.60	63.49	91.40	63.24
364	92.40	64.97	89.20	63.92	92.40	63.28	90.90	63.03
363	91.50	64.75	88.30	63.71	91.90	63.06	89.80	62.83
362	91.00	64.54	87.80	63.50	91.60	62.85	89.20	62.62
361	91.00	64.33	87.70	63.29	91.50	62.64	88.90	62.41
360	90.30	64.12	87.00	63.07	90.40	62.43	88.50	62.20
359	89.20	63.90	85.90	62.86	88.50	62.22	87.20	62.00
358	88.80	63.69	85.40	62.65	87.60	62.00	86.00	61.79
357	87.70	63.48	84.20	62.44	86.40	61.79	83.80	61.58
356	86.40	63.27	82.90	62.22	84.50	61.58	80.70	61.38
355	86.20	63.05	82.80	62.01	83.80	61.37	79.80	61.17
354	85.70	62.84	82.50	61.80	83.20	61.16	78.90	60.96
353	85.20	62.63	82.10	61.58	82.50	60.94	77.80	60.75

Score	XI				XII			
	Male		Female		Male		Female	
	PR	T Score	PR	T Score	PR	T Score	PR	T Score
352	84.90	62.42	81.70	61.37	82.10	60.73	76.70	60.55
351	84.50	62.20	81.40	61.16	81.30	60.52	75.70	60.34
350	83.80	61.99	80.90	60.95	80.40	60.31	75.00	60.13
349	82.60	61.78	79.60	60.73	78.60	60.10	73.10	59.92
348	81.80	61.57	78.70	60.52	77.20	59.88	71.80	59.72
347	81.10	61.35	78.30	60.31	76.90	59.67	71.70	59.51
346	79.20	61.14	76.70	60.10	74.90	59.46	70.30	59.30
345	77.80	60.93	75.40	59.88	73.20	59.25	69.00	59.10
344	77.80	60.72	75.40	59.67	73.20	59.04	69.00	58.89
343	77.80	60.50	75.40	59.46	73.20	58.82	69.00	58.68
342	77.10	60.29	74.70	59.24	72.80	58.61	67.60	58.47
341	76.40	60.08	74.00	59.03	72.40	58.40	66.20	58.27
340	75.70	59.87	72.60	58.82	71.70	58.19	65.00	58.06
339	75.00	59.65	71.20	58.61	71.00	57.98	63.80	57.85
338	75.00	59.44	71.20	58.39	71.00	57.76	63.80	57.64
337	74.40	59.23	70.40	58.18	70.50	57.55	63.30	57.44
336	73.80	59.02	69.60	57.97	70.00	57.34	62.80	57.23
335	73.60	58.80	69.40	57.76	69.80	57.13	62.80	57.02
334	73.40	58.59	69.20	57.54	69.60	56.91	62.80	56.82
333	73.40	58.38	69.20	57.33	69.60	56.70	62.80	56.61
332	73.40	58.17	69.20	57.12	69.60	56.49	62.80	56.40
331	73.40	57.95	69.20	56.90	69.60	56.28	62.80	56.19
330	73.40	57.74	69.20	56.69	69.60	56.07	62.80	55.99
329	73.20	57.53	69.00	56.48	69.40	55.85	62.80	55.78
328	72.20	57.32	68.40	56.27	68.30	55.64	61.70	55.57
327	71.40	57.10	68.00	56.05	67.40	55.43	60.60	55.36
326	70.90	56.89	67.60	55.84	66.60	55.22	60.50	55.16
325	69.70	56.68	66.90	55.63	65.50	55.01	60.40	54.95
324	67.80	56.47	65.80	55.42	64.60	54.79	59.50	54.74
323	65.30	56.25	62.90	55.20	61.90	54.58	56.50	54.54
322	63.40	56.04	60.20	54.99	59.20	54.37	53.50	54.33
321	62.80	55.83	59.60	54.78	58.60	54.16	52.60	54.12
320	62.80	55.62	59.60	54.56	58.60	53.95	52.60	53.91
319	62.80	55.40	59.60	54.35	58.60	53.73	52.60	53.71
318	62.80	55.19	59.60	54.14	58.60	53.52	52.50	53.50
317	62.80	54.98	59.60	53.93	58.60	53.31	52.40	53.29
316	62.50	54.77	59.20	53.71	58.50	53.10	52.00	53.08
315	62.20	54.55	58.80	53.50	58.40	52.89	51.60	52.88
314	62.10	54.34	58.60	53.29	58.30	52.67	51.50	52.67
313	61.10	54.13	57.90	53.08	57.20	52.46	50.30	52.46
312	59.60	53.92	57.10	52.86	56.00	52.25	49.10	52.26
311	59.00	53.70	56.80	52.65	55.80	52.04	49.00	52.05
310	58.60	53.49	56.70	52.44	55.80	51.83	49.00	51.84

Score	XI				XII			
	Male		Female		Male		Female	
	PR	T Score	PR	T Score	PR	T Score	PR	T Score
309	58.20	53.28	56.60	52.23	55.80	51.61	49.00	51.63
308	58.20	53.07	56.60	52.01	55.80	51.40	48.90	51.43
307	58.00	52.85	56.20	51.80	55.60	51.19	48.30	51.22
306	57.20	52.64	55.50	51.59	55.10	50.98	47.80	51.01
305	56.50	52.43	55.00	51.37	54.70	50.77	47.80	50.81
304	56.40	52.22	54.80	51.16	54.60	50.55	47.80	50.60
303	56.40	52.00	54.80	50.95	54.60	50.34	47.80	50.39
302	56.40	51.79	54.80	50.74	54.60	50.13	47.80	50.18
301	56.40	51.58	54.80	50.52	54.60	49.92	47.80	49.98
300	56.40	51.37	54.80	50.31	54.60	49.70	47.80	49.77
299	56.30	51.15	54.80	50.10	54.60	49.49	47.80	49.56
298	55.90	50.94	54.60	49.89	54.40	49.28	47.80	49.35
297	55.60	50.73	54.40	49.67	54.20	49.07	47.80	49.15
296	55.60	50.52	54.40	49.46	54.20	48.86	47.80	48.94
295	55.60	50.30	54.40	49.25	54.20	48.64	47.70	48.73
294	55.50	50.09	54.40	49.03	54.20	48.43	47.60	48.53
293	54.90	49.88	53.30	48.82	52.50	48.22	46.00	48.32
292	54.40	49.67	52.20	48.61	50.80	48.01	44.40	48.11
291	54.00	49.45	51.40	48.40	50.40	47.80	43.80	47.90
290	53.60	49.24	50.60	48.18	50.00	47.58	43.20	47.70
289	52.40	49.03	49.50	47.97	48.60	47.37	40.70	47.49
288	50.40	48.82	47.10	47.76	46.50	47.16	37.70	47.28
287	49.60	48.60	45.80	47.55	45.80	46.95	37.20	47.07
286	49.60	48.39	45.80	47.33	45.80	46.74	37.20	46.87
285	49.60	48.18	45.80	47.12	45.80	46.52	37.20	46.66
284	49.60	47.97	45.80	46.91	45.80	46.31	37.20	46.45
283	49.50	47.75	45.60	46.69	45.50	46.10	36.30	46.25
282	48.40	47.54	44.50	46.48	44.00	45.89	34.20	46.04
281	47.00	47.33	43.50	46.27	42.70	45.68	33.00	45.83
280	46.50	47.12	43.40	46.06	42.60	45.46	33.00	45.62
279	44.80	46.90	42.10	45.84	41.10	45.25	32.50	45.42
278	43.20	46.69	40.80	45.63	39.60	45.04	32.00	45.21
277	41.90	46.48	39.80	45.42	38.30	44.83	30.70	45.00
276	40.50	46.26	38.60	45.21	36.90	44.62	29.40	44.79
275	40.40	46.05	38.40	44.99	36.80	44.40	29.40	44.59
274	40.40	45.84	38.40	44.78	36.80	44.19	29.40	44.38
273	40.40	45.63	38.40	44.57	36.80	43.98	29.40	44.17
272	39.50	45.41	36.80	44.35	35.40	43.77	28.10	43.97
271	38.60	45.20	35.20	44.14	34.00	43.56	26.80	43.76
270	38.60	44.99	35.20	43.93	34.00	43.34	26.80	43.55
269	38.60	44.78	35.20	43.72	34.00	43.13	26.80	43.34
268	38.60	44.56	35.20	43.50	34.00	42.92	26.80	43.14
267	38.60	44.35	35.20	43.29	34.00	42.71	26.80	42.93

Score	XI				XII			
	Male		Female		Male		Female	
	PR	T Score	PR	T Score	PR	T Score	PR	T Score
266	38.60	44.14	35.20	43.08	34.00	42.49	26.80	42.72
265	37.00	43.93	33.10	42.87	32.10	42.28	25.40	42.51
264	35.20	43.71	30.50	42.65	29.70	42.07	23.80	42.31
263	34.50	43.50	29.00	42.44	28.00	41.86	22.30	42.10
262	33.10	43.29	27.60	42.23	26.50	41.65	20.90	41.89
261	31.90	43.08	27.20	42.01	26.20	41.43	20.80	41.69
260	31.10	42.86	26.90	41.80	25.40	41.22	20.70	41.48
259	29.70	42.65	24.80	41.59	22.90	41.01	19.30	41.27
258	28.80	42.44	23.00	41.38	21.20	40.80	18.00	41.06
257	27.40	42.23	22.30	41.16	20.60	40.59	17.00	40.86
256	25.90	42.01	21.60	40.95	20.00	40.37	16.00	40.65
255	25.80	41.80	21.60	40.74	20.00	40.16	16.00	40.44
254	25.60	41.59	21.60	40.53	20.00	39.95	16.00	40.23
253	25.20	41.38	21.60	40.31	20.00	39.74	15.90	40.03
252	24.70	41.16	21.60	40.10	19.50	39.53	15.40	39.82
251	24.40	40.95	21.60	39.89	19.00	39.31	15.00	39.61
250	23.10	40.74	20.40	39.67	17.80	39.10	14.80	39.41
249	21.00	40.53	18.40	39.46	15.50	38.89	13.60	39.20
248	19.60	40.31	16.40	39.25	13.40	38.68	12.00	38.99
247	18.70	40.10	15.10	39.04	12.30	38.47	11.30	38.78
246	18.40	39.89	14.90	38.82	12.20	38.25	11.20	38.58
245	18.30	39.68	14.60	38.61	12.10	38.04	11.20	38.37
244	16.10	39.46	12.40	38.40	10.00	37.83	9.00	38.16
243	13.90	39.25	10.30	38.19	8.00	37.62	6.80	37.95
242	13.10	39.04	9.60	37.97	7.70	37.41	6.70	37.75
241	12.40	38.83	9.00	37.76	7.40	37.19	6.60	37.54
240	12.30	38.61	9.00	37.55	7.40	36.98	6.60	37.33
239	10.80	38.40	7.50	37.34	6.50	36.77	5.50	37.13
238	8.90	38.19	5.80	37.12	5.40	36.56	4.20	36.92
237	8.30	37.98	5.60	36.91	5.20	36.35	4.00	36.71
236	7.20	37.76	4.60	36.70	4.20	36.13	3.40	36.50
235	6.20	37.55	3.40	36.48	3.20	35.92	2.80	36.30
234	6.10	37.34	3.10	36.27	3.00	35.71	2.70	36.09
233	5.50	37.13	3.00	36.06	2.60	35.50	2.40	35.88
232	4.30	36.91	2.10	35.85	1.70	35.28	1.50	35.68
231	2.80	36.70	1.10	35.63	0.70	35.07	0.60	35.47
230	2.00	36.49	1.00	35.42	0.40	34.86	0.40	35.26
229	1.90	36.28	1.00	35.21	0.40	34.65	0.40	35.05
228	1.80	36.06	1.00	35.00	0.40	34.44	0.40	34.85
227	1.70	35.85	1.00	34.78	0.40	34.22	0.40	34.64
226	1.60	35.64	0.80	34.57	0.40	34.01	0.40	34.43
225	1.40	35.43	0.50	34.36	0.30	33.80	0.30	34.22
224	1.20	35.21	0.40	34.14	0.20	33.59	0.20	34.02

Score	XI				XII			
	Male		Female		Male		Female	
	PR	T Score	PR	T Score	PR	T Score	PR	T Score
223	1.00	35.00	0.40	33.93	0.10	33.38	0.10	33.81
222	0.80	34.79	0.40	33.72	0.00	33.16	0.00	33.60
221	0.40	34.58	0.40	33.51	0.00	32.95	0.00	33.40
220	0.00	34.36	0.40	33.29	0.00	32.74	0.00	33.19
219	0.00	34.15	0.40	33.08	0.00	32.53	0.00	32.98
218	0.00	33.94	0.40	32.87	0.00	32.32	0.00	32.77
217	0.00	33.73	0.20	32.66	0.00	32.10	0.00	32.57

PR will help to identify the exact position of the person taking the test in the entire population. It can also help the teachers counsellor and researchers to make qualitative decision regarding the score. For this letter grades indicating the level of performance were assigned. The following pattern was followed for the same.

Table : 6.4.2.(C)
Grade and level of self-regulation

PR range	Letter Grade	Level of Self regulation
80 or Above	A	Very Good
60.00 to 79.99	B	Good
40.00 to 59.99	C	Average
20.00 to 39.99	D	Below Average
Below 20	E	Poor

6.5.0 Test Manual :-

Test manual performs the role of a navigator. It guides the prospective users of the test about how to use the test, the precautions to be taken. The instructions to be given, how the scoring is to be done and interpreting the score correctly and scientifically to arrive at a sound judgement for the person taking the test. So any test without the manual is meaningless and serves no purpose. Manual makes it possible for the test to be used for diagnostic and remedial purposes.

6.5.1 Pre-conditions for administering the SRL inventory :-

The present tool (SRL Inventory) can be used only for Gujarati Medium Higher secondary student studying in Science and General stream of schools situated in Urban and rural areas of central Gujarat region.

6.5.2 Administering the SRL Inventory :-

- Ensure students fill in all required personal details in the spaces provided.
- Explain thoroughly with the help of illustration on how to respond on statements.
- Give proper explanation about the alphabets representing various response categories.
- Make it very clear that there is no fixed right or wrong response (answer) for any of the statement
- Ask them to respond freely and frankly without any fear.
- Reassure them about the secrecy of the data.
- Time limit is not fixed as this is not a performance test but allow 20 – 25 minutes to complete the inventory.

6.5.3 Scoring the responses :-

SRL inventory contains 45 positive and 35 negative statements. The response categories A to E carry values to 5 to 1 for positively worded statements. For negatively worded statements, the value for response categories to A to E are reversed as 1 to 5. So the range of score varies from 80 to 400.

Table No. 6.5.3
Scoring Scheme

Sr. No.	**Sub section**	**Sr. No. of positively worked statements in the final inventory**		**Sr. No. of negatively worked statements in the final inventory.**	
1	Metacognition (28)	1, 2, 3, 4, 6, 7, 8, 9, 10, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26 **(21)**		5, 11, 12, 13, 16, 27, 28 **(07)**	
2	Motivation (24)	30, 32, 38, 40, 42, 43, 44, 48, 51 **(09)**		29, 31, 33, 34, 35, 36, 37, 39, 41, 45, 46, 47, 49, 50, 52 **(15)**	
3	Behaviour (28)	53, 55, 56, 58, 59, 65, 67, 68, 69, 71, 73, 75, 77, 79, 80 **(15)**		54, 57, 60, 61, 62, 63, 64, 66, 70, 72, 74, 76, 78 **(13)**	
	Scoring Scheme	Response Category	Score	Response Category	Score
		A	**5**	A	**1**
		B	**4**	B	**2**
		C	**3**	C	**3**
		D	**2**	D	**4**
		E	**1**	E	**5**

6.5.4 Conversion of Raw scores into PR and T score :-

- Read the response category and convert them into scores as shown in table 6.5.3
- Work out the total raw score on SRL inventory.
- Ascertain the gender and standard of the student responding to SRL Inventory.
- Select the column representing the Gender and Standard of the student.
- Find the position of total Raw score obtained by that particular student in the first column.
- Read the corresponding PR and T-score for the said raw score of that particular student from the respective column.

6.5.5 Qualitative Interpretation of PR :-

Refer to the table No. 6.4.2.(C) and decide the level of self regulation by using PR of the student. One can also decide the position of the student in a particular group of students with the help of the PR read from table 6.4.2.(B)

6.6.0 Conclusion :-

In this chapter, the compiled data was processed and subjected to various statistical techniques and it was established that the SRL inventory is reliable and valid. Norms were also established in terms of PR and T-Score for Gender and Standard of the students. The chapter Seven deals with the classification, analysis and interpretation of the data.

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